International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 01 | Jan 2022 www.irjet.net p-ISSN: 2395-0072

Visible Light Communication Using LED's and LDR

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Abstract - *The possibility of noticeable light correspondence (Visible Light Communication) is introduced in this report. In VLC, from the electromagnetic (EM) recurrence range the noticeable light piece is utilized for data interchange which is comparable to standard sorts of wi-fi verbal exchange consisting of Bluetooth and wireless- fidelity (WiFi), wherein information or data is communicated over the remote medium utilizing radio recurrence (RF) signals. Via modulating the force of light sources like LED is utilized as a transmitter and a photosensitive indicator like LDR is utilized for demodulation of the light motions toward convert once again into electrical structure as a receiver. There is a significant requirement for the advancement of unusual advances like VLC, to defeat the issue looked by the traditional remote correspondence framework. In this document, the primary transmission and receiving protocol is mentioned.*

***Key Words*: WiFi, RF signals, LDR, VLC, Modulation, EM frequency.**

1. INTRODUCTION

The current Wireless communication is susceptible to interception but VLC makes it so that whenever the Transmitter and receiver pair are in the Line of sight of each other an uninterrupted and secure communication can take place as we can use different frequencies to send data the sheer number of frequencies at which the Lightwave can be modulated which makes it very unique and in turn ensure scalability.

1.1 Transmission protocol

The transmission protocol is designed such that it can send 4-bit data. It is written on ARM-based MCU and uses Pulse Width Modulation at different frequencies and duty cycles to represent 1 and 0. The data frame has a start-bit and ensures transmission of the data.

1.2 Receiving Protocol

After receiving the electrical signal back the data frame is deciphered and various filtering is applied so that no false data is received. Receiving is done on ARM-based MCU.

1.3 Input Capture Protocol

Input Capture Protocol helps us to know what is the frequency of the input wave, it uses simple logic of interrupts and counters to know what is the frequency of the input square wave

1.4 Present Scenario

As compared to RF engineering, Optical Wireless Communication (OWC) Engineering has a long history. In the past for the dissemination of news, the natural form of visible light was used for visual communication. Smoke signals, beacon fires, lighthouses, and signal markers were used by human beings to communicate across long distances at light speed. Graham Bell has made his first experimental setup of VLC in 1880, known as Photophone. VLC is a stream of OWC. Also, OWC contains Ultra Violet (UV) and Infrared (IR) communication. VLC is unique in nature than IR and UV because the light sources used for illumination purposes are also used for communication purposes using the same visible light energy. In VLC, the intensity of the LED light sources is modulated in such a way that light flicker is imperceptible to the human eyes. The light signal is demodulated back into electrical form by the photosensitive detector which is called a VLC receiver. After the application of continuous and constant current to LED light sources, it emits a continuous stream of photons which is called visible light. The transmitter transmits light at a different frequency concerning up and down (digital 1 and 0) current is flowing through a light source. The light source output frequency can be sensed by a photosensitive material like LDR but is imperceptible to the human eyes. LEDs are semiconductor devices and LED light sources can be used to transmit high-speed data using this technique. Large data rates can be achieved using higher intensity LED light sources. Low power consumption and highly efficient LEDs are used to replace all high-power consuming and inefficient light sources like fluorescent tubes by various governments worldwide.

2. BLOCK DIAGRAM

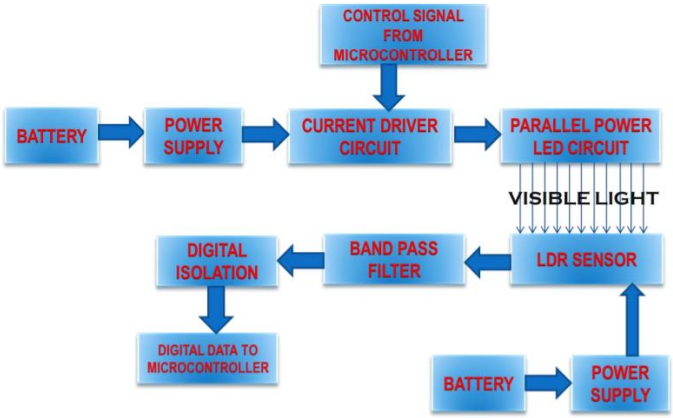

Chart -1: Block Diagram of the System

2.1 Transmitter

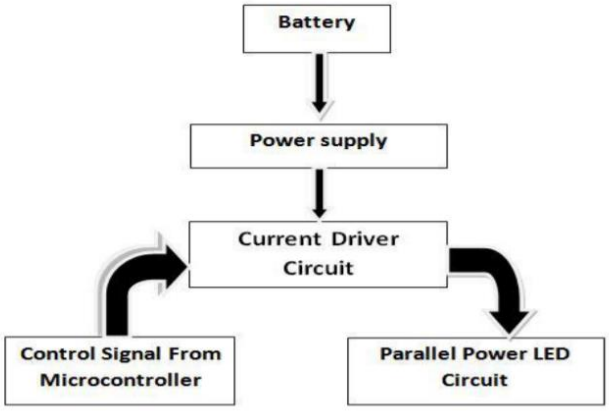

Chart -2: Block Diagram of the Transmitter

The transmitter setup consists of a mixture of transmitting node, microcontroller-board, PTN board, and the power supply. The connection of power batteries to PTN board is made using T-connector and further, it is connected to the Transmitting node again using T-connector. The controller board and transmitting node are connected using a 4-pin cable

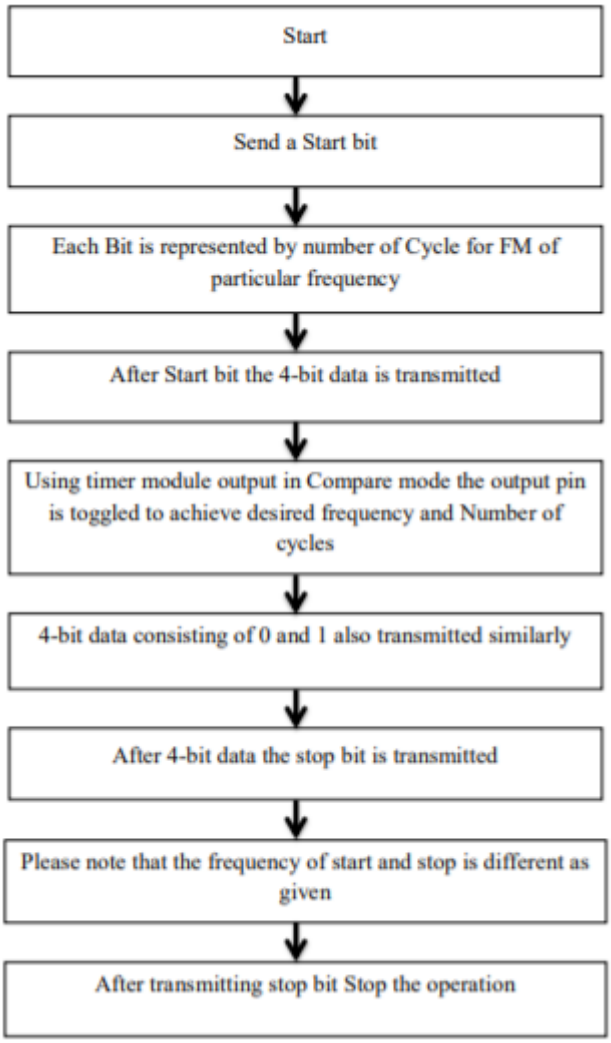

Chart -3: Algorithm of the Transmitter

2.2 Receiver

The Receiving setup is a mixture of microcontroller-board, receiving node, and the power supply. The power battery is connected to receiving node using a T connector. The controller board and receiving node are connected using a 4-pin cable.

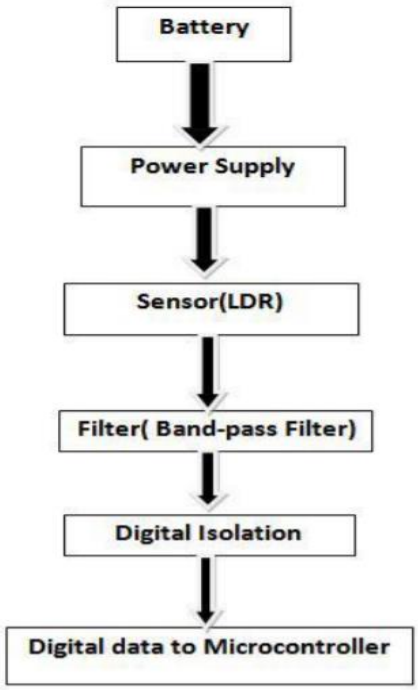

Chart -4: Block Diagram of the Receiver

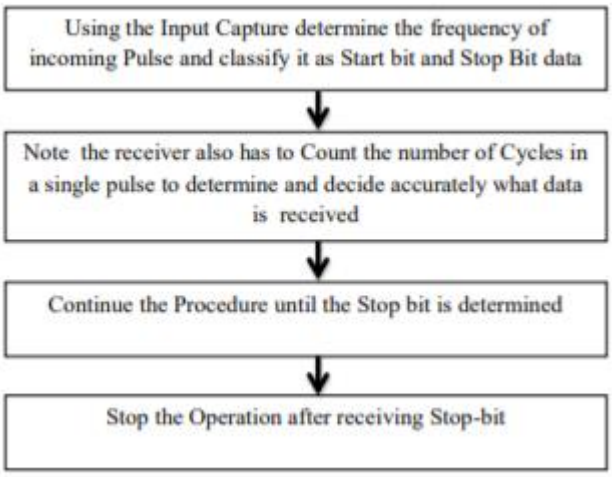

Chart -5: Algorithm of the Receiver

2.3 Advantages

VLC has the following advantages over existing wireless communication networks:

1. Capability: The visible light frequency spectrum is 10000 times higher than the RF frequency spectrum. Also, the visible light spectrum belongs to ISM (Industrial, Scientific, and Medical) band which is unlicensed and cost-free. Nearby 1000x data density of RF can be achieved in VLC as RF spread out and produces interferences in nearby while visible light is inflexible in lighting boundary. VLC system has high device bandwidths, high-intensity optical output, and low interference. This can be used to achieve high data rates. RF is invisible and makes network planning complicated. With VLC capability is simple as the user needs a simple setup with good signal power which can be correctly observed.

2. Productivity: VLC requires fewer components than radio technology. It is a low-cost solution. Data transmission requires negligible power using LED light sources and LED light is efficient. In underwater communication, VLC works well than RF transmission. Underwater RF communication is extremely difficult as the attenuation of signals is more.

3. Safety: The lifecycle in the universe is progressing with experience to visible light. There is no known medical health issue or protection about VLC. In VLC like RF communication, complex antennas are not required for data transmission through the light from the light source. RF antennas are hazardous in locations like chemical plants, hospitals.

4. Security: Boundaries of communication in VLC are restricted to the illumination region only as visible light does not cross walls of the illuminated region. Control of the data directly between transmitter and receiver is easy as we can see the direction of the data moving. Like Bluetooth & Wi-Fi, additional security is not essential such as pairing or passing keys for RF interconnections.

3. CONCLUSION

This report describes how a VLC can be implemented cost-effectively. It also summarizes various uses of VLC in daily life. It discusses the data frame which was used to transmit data also a brief description of various protocols is given we believe that VLC will greatly enhance human life and will result in the advancement of communication technology.

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